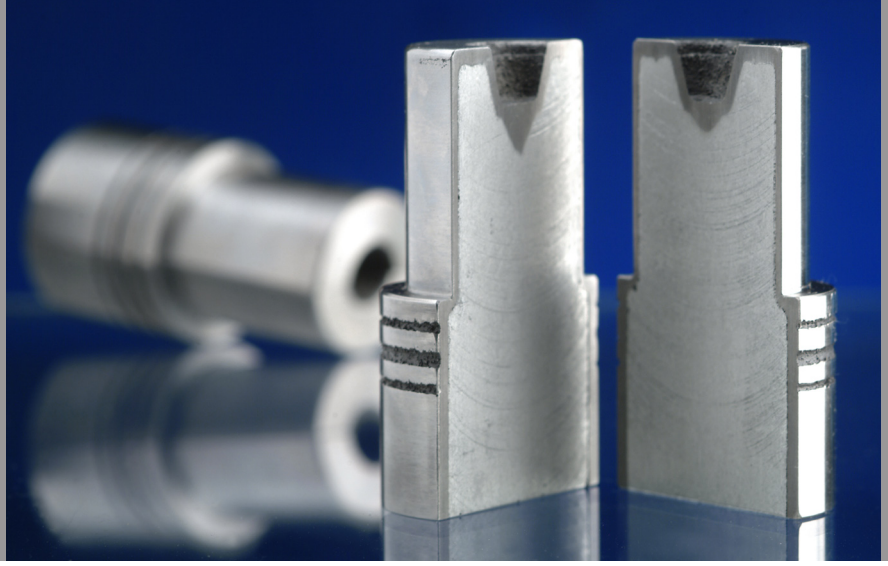

TOOLS MADE OUT OF COMBINED MATERIALS

Selective Laser Melting (SLM)

Selective Laser Melting (SLM) is an Additive Manufacturing method for producing complex metallic components. In this process metallic serial materials, such as tool steel 1.2343 or 1.2709 in powder form, are directly melted and processed into dense components by means of laser radiation.

Tools with near-net shape temperature control

Increasingly, SLM is being used to directly manufacture mold inserts for injection-molded machine tools. The high amount of geometrical freedom SLM offers is used to produce inserts having complexly formed near-net cooling channels with varying cross-sectional geometries. Thereby, an extremely effective temperature control can be attained. The construction of near-net shaped cooling channels can, however, be very time consuming depending on the tool geometry. Furthermore, the optimal dimensioning of the cooling channels is often limited by the tool geometry and the position of other functional components, such as ejector pins.

Tools made out of a combination of materials

As an alternative to temperature control by means of complex near-net shaped cooling channels, the Fraunhofer ILT has developed the manufacture of mold inserts from a combination of materials, collaborating with the Casting Institute of the RWTH Aachen University. In this application, the advantages of tool steel with higher wear resistance and, e. g., aluminum with high heat conductivity are to be unified in one component.

The manufacture occurs in a two-step process: in a first step, the shell of the tool is additively manufactured by means of SLM from wear-resistant tool steel, such as 1.2343. After the shell has been constructed, the excess powder is removed from the hollow spaces. In a second step, the core is filled with a highly heat-conductive working material, such as aluminum. Finally, the last processing takes place using conventional manufacturing technology.

The advantages of such mold inserts are:

- Short production time for additive manufacturing
- Very homogenous temperature control of the tool through the highly heat-conductive core
- Lower production costs since no or only a simple temperature-control channel is necessary
- Wear-resistant shell

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1 Tool shell: Steel (hardness 53 HRC), Tool core: aluminum (heat conductivity over 250 W/mK).